IJAE
Vol. 119, n. 1 (Supplement): 31, 2014
ITALIAN JOURNAL OF ANATOMY AND EMBRYOLOGY

Biocompatibility evaluation of PLLA scaffolds for vascular tissue engineering

Gaetano Felice Caldara[1], Salvatrice Rigugliuso[1], Francesco Carfì Pavia[2], Valerio Brucato[2], Giulio Ghersi[1]

[1] STEBICEF Department, University of Palermo, 90128 Palermo, Italy
[2] DICAM Department, University of Palermo, 90128 Palermo Italy

Poly-L-lactic acid (PLLA), a hemicrystalline material, has been extensively studied in applications of engineered tissues, because it is biodegradable, absorbable and it supports cell attachment and growth. The purpose of this study is to evaluate tissue/material interactions, neovascularization and the biocompatibility of PLLA by optical and scanning electron microscopy in a model of animal implant.

PLLA porous disks were implanted into the dorsal subcutis of BALB/C mice for 1, 2, 3, and 8 weeks. The bioptic samples of excised PLLA and the surrounding tissue were evaluated for inflammatory response and tissue ingrowth. The samples were divided in two halves: one was fixed in neutral buffered formaldehyde for 24 hours, embedded in parraffin blocks, and cut into 8-μm-thick sections. The other half was fixed with 4% glutaraldehyde, dehydrated, gold coated, and was then observed with an scanning electron microscope (FEGESEM QUANTA 200 FEI). The anatomopathological examination of the implant site revealed no significant inflammatory response. The histological analysis revealed a thin fibrous capsule and a minimal inflammatory reaction with polymorphonuclear leukocytes, lymphocytes, monocytes and plasma cells around the implant, which died out during the second week. The presence of neutrophils and lymphocytes was detected until the second week after the implantation and a trama of connective tissue was found on the pores of the scaffold during the first week.

The presence of giant cells was detected in the final stage of the inflammatory response and healing, which mainly occurred during the second week after the implantation. In addition, a significant angiogenic activity on the external implant surface was observed during the third week. 8 weeks after the implant, the inflammatory cell response was absolutely minimal, with an intense angiogenic activity occurring within the scaffold. This study shows the following results: PLLA has a high degree of biocompatibility and angiogenic potential; moreover, scaffolds are biocompatible in terms of cell survival and proliferation, as they stimulate a minimal inflammatory response while supporting cell infiltration, the matrix apposition and neo vascularization.

Keywords

Poly-L-lactic acid, (PLLA), biocompatibility, immune responce, implant, scaffold, angiogenesis.